Fermilab — Fermi National Accelerator Laboratory

Technical Division-Machine Shop

Procedure Qualification Record — No. Fermi PQR Ti-3 — Date 12/10/2008

Revision: 2 Date: 6/17/09 Remarks: Added tungsten requirements

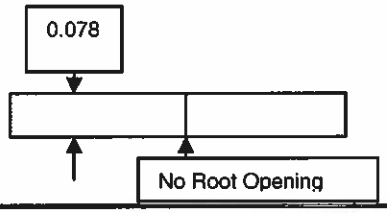
Welding Process/Weld Type: *GTAW/Automatic* | Supporting: ***Fermi WPS Ti-3***

Joints (QW-402)

Weld Type:	*Single V Groove Weld*
Backing:	*Open Butt, Gas Backing Only*
Root Opening:	*0.0"*
Root Face:	*0.078"*

Details:

0.078 Wall x 3" diameter
AMI Orbital Machine Model 227-STD1.9



Base Metals (QW-403)
Material Spec., Type or Grade
SB-861, Grade 2 to *SB-861, Grade 2*
P-No. *51* to **P-No.** *51*
Thickness of Coupon (in.) *0.078 inches*
Diameter of Test Coupon (in.) *3 inches*

Post Weld Heat Treatment (QW-407)
Type: *No PWHT performed*
Temperature: *None*
Time: *None*

Filler Metals (QW-404) *None, Autogenous*
SFA Specification/ AWS Classification
Filler Metal F/ Analysis A-No
Size of Filler Metal (in.):
Weld Deposit "t"(in.):
Filler Metal Product Form:

Gas (QW-408)

	Gas	Percent Composition Mixture%	Flow Rate
Shielding:	*Argon*	*>99.995%*	*@ 30 CFH*
Trailing:		*None*	
Backing:	*Argon*	*>99.995%*	*@ 7 CFH*

Other: ***Closed chamber head with internal backing***

Positions (QW-405)
Position of Joint: *6G*
Weld progression: *Upward & Downward*

Preheat (QW-406)
Preheat Temperature: *Ambient 67° F*
Interpass Temperature: *350° F Maxium*

Electrical Characteristics (QW-409)
Current/Polarity: *DCEN Pulsed Current*
Amps/Volts: *See Chart/Volts 10-15*
Tungsten Type : *1/16 diameter, EWCe-2*

Travel (ipm): *As Required* **Oscillation:** *None*
String/Weave Bead: *Stringer*
Multiple/Single Pass (per side) *Multiple one side*
Multiple/Single Electrode: *Single Electrode*

Sequence Chart

Weld Levels	Pulse	Rotation	RPM Primary IPM	RPM Back IPM	Time Sec.	AMPS Primary	AMPS Back	PULSE Primary Per sec	PULSE Back Per sec	Other Requirements
1	ON	Continuous	0.42	---	5	91	50	0.30	0.30	*Voltage preset by Mfg. Mfg. pre-ground/pre-shaped and sized Tungsten required Mfg. Part # TC06-1085-03*
2	ON	Continuous	0.42	---	50	91	50	0.30	0.30	
3	ON	Continuous	0.42	---	46	91	50	0.30	0.30	
4	ON	Continuous	0.42	---	21	90	50	0.30	0.30	*Arc gap set at .050 in.*
5	ON	Continuous	0.42	---	25	90	50	0.30	0.30	
6	ON	Continuous	0.42	---	30	91	50	0.30	0.30	

Prepared by Roger Hiller

Fermilab ***Fermi National Accelerator Laboratory***

Technical Division-Machine Shop

Procedure Qualification Record	**No.** ***Fermi PQR Ti-3***	Date	*6/13/2008*
Welding Process/Weld Type: *GTAW/Manual*	Supporting: ***Fermi WPS Ti-3***		

Tensile Test (QW-150)

Specimen No.	Width (in.)	Thickness (in.)	Area (Squared in.)	Ultimate Total Load (lbs.)	Ultimate Stress (PSI)	Failure Type & Location
1	*0.755*	*0.079*	*0.0596*	*3624*	*60,759*	*Ductile-WM*
2	*0.754*	*0.079*	*0.0596*	*3655*	*61,361*	*Ductile-WM*

Guided Bend Test (QW-160)

Figure Number & Type	Result	Figure Number Type	Result
QW-462.3 (a) Face Bend	***Acceptable***	QW-462.3 (a) Root Bend	***Acceptable***
QW-462.3 (a) Face Bend	***Acceptable***	QW-462.3 (a) Root Bend	***Acceptable***

Visual Examination: *Acceptable*

Welder's Name: *Michael P. Reynolds* **ID #** *03993N* **Weld Stamp #** *9*

Welding of coupon witnessed by: *Roger Hiller* *FNAL #00362N*

Tests Conducted by: *Bodycote Testing Group* **Test ID#:** *1215-008/02*

We Certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in accordance with the requirements of Section IX of the ASME Code.

PQR prepared by: ***Fermi National Accelerator Laboratory***

Authorized Representative _____ ID# ***00362N***